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Ultrasound-assisted extrusion of construction ceramic samples

G.R. Faseeva, R.M. Nafikov, S.E. Lapuk, Yu.A. Zakharov, A.A. Novik, A.A. Vjuginova, R.R. Kabirov, L.N. Garipov



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G.R. Faseeva¹, R.M. Nafikov¹, S.E. Lapuk¹, Yu.A. Zakharov^{1*}, A.A. Novik², A.A. Vjuginova², R.R. Kabirov³, L.N. Garipov³

¹Institute of Physics, Kazan Federal University, 18, Kremlevskaya Str., Kazan, 420008, Russia

²JSC "Inlab-Ultrazvuk", 20, Chugunnaia Str., Saint-Petersburg, 194044, Russia

³ Plant «Aleksievskaya keramika», 10, Kirpichnjavodskaya Str., Aleksievskoe, Tatarstan, 422900, Russia

*Corresponding author: zaha1964@yandex.ru

Abstract

The conditions for a decrease in friction during ceramic brick production between a mixture and an extruder die under the influence of 20 - 30 kHz ultrasound applied to the die are calculated. An optimum design of a die used to mold 30 mm diameter cylindrical samples with a resonance in this frequency range is selected using computer modeling. From the results, a titanium die is fabricated and tested on a Verdes-050 (Spain) laboratory extruder using an ultrasonic magnetostrictive transducer with a power of 1.5 kW (Inlab-Ultrazvuk, Russia). A 12% reduction in extrusion pressure, a 20% acceleration of molding and a positive influence on the properties of the ceramics were found. The surface of the ceramic samples was covered by craters with diameters of approximately 10 microns due to the boiling of water, and the porosity of the main body of the samples decreased. This technique prevents the undesirable rapid drying of the surface when the samples exit the die and stabilizes the strength of the fired samples. The color remained unchanged, the water absorption decreased, the density, strength and resistance to frost increased. Ultrasonic extrusion increased the accuracy of the strength tests of construction ceramics, indicating the prospect of ultrasonic die development for industrial extruders for bricks, facing tiles and roof tiles.

Keywords: construction ceramics, extrusion, die, brick, ultrasound

1. Introduction

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